

WE CLAIM:

1. In a solid oxide fuel cell comprising an anode electrode, a cathode electrode and an electrolyte disposed between said anode electrode and said cathode electrode, a method for generating electricity comprising the steps of:

contacting said anode electrode with a dry fluid fuel selected from the group consisting of hydrocarbons, carbonaceous materials and mixtures thereof;

contacting said cathode electrode with an oxidant; and

directly oxidizing said dry fluid fuel in said solid oxide fuel cell, resulting in generation of electricity.

2. A method in accordance with Claim 1, wherein said oxidation is carried out at a voltage potential in a range of about 0 to about 1.1 volts.

3. A method in accordance with Claim 1, wherein said anode electrode comprises a porous YSZ layer and one of a metal and a metal alloy comprising an electron-conducting metal having an oxide form that melts at a temperature less than about 1550°C.

4. A method in accordance with Claim 3, wherein said electron-conducting metal is selected from the group consisting of Cu, Ni and alloys thereof.

5. A method in accordance with Claim 3, wherein said anode electrode further comprises ceria.

6. A method in accordance with Claim 1, wherein said dry fluid fuel comprises at least two carbon atoms.

7. A method in accordance with Claim 6, wherein said dry fluid fuel comprises in a range of 2 to 20 carbon atoms.

8. A method in accordance with Claim 1, wherein said dry fluid fuel is selected from the group consisting of methane, alcohols, toluene, n-decane, synthetic diesel fuels and mixtures thereof.

9. A method in accordance with Claim 3, wherein said electron-conducting metal comprises at least about 10% by weight of said porous YSZ layer.

10. A method in accordance with Claim 5, wherein said ceria comprises in a range of about 5% to about 40% by weight of said porous YSZ layer.

11. A method for direct oxidation of dry fluid fuel comprising the steps of:

introducing said dry fluid fuel directly into an anode side of a solid oxide fuel cell comprising an anode electrode comprising a porous YSZ layer and one of a metal and a metal alloy comprising an electron-conducting metal having an oxide form which melts at a temperature of less than about 1550°C, a cathode electrode and an electrolyte disposed between said anode electrode and said cathode electrode;

introducing an oxidant into a cathode side of said solid oxide fuel cell;
and

electrochemically reacting said dry fluid fuel and said oxidant, whereby said dry fluid fuel is oxidized to produce electrical energy.

12. A method in accordance with Claim 11, wherein said dry fluid fuel comprises at least two carbons.

13. A method in accordance with Claim 12, wherein said dry fluid fuel comprises in a range of about 2 to about 20 carbons.

14. A method in accordance with Claim 11, wherein said dry fluid fuel is selected from the group consisting of methane, alcohols, toluene, n-decane, synthetic diesel fuels and mixtures thereof.

15. A method in accordance with Claim 11, wherein said electron-conducting metal is selected from the group consisting of Cu, Ni and alloys thereof.

16. A method in accordance with Claim 11, wherein said anode electrode further comprises ceria.